

II. "On a new Relation between Heat and Electricity."

By FREDERICK GUTHRIE. Received January 10, 1873.

(Abstract.)

It is found that the reaction between an electrified body and a neighbouring neutral one, whereby the electricity in the neutral body is inductively decomposed and attraction produced, undergoes a modification when the neutral body is considerably heated.

Under many circumstances it is found that the electrified body is rapidly and completely discharged. The action of discharge is shown to depend mainly upon the following conditions:—(1) the temperature of the discharging body and its distance from the electrified one; (2) the nature (+ or —) of the latter's electricity.

With regard to (1), it is shown that the discharging power of a hot body diminishes as its distance increases, and increases with its temperature; but, concerning the temperature, it is proved that the discharging power of a hot body does not depend upon the quantity of heat radiated from it to the electrified body, but chiefly upon its quality. Thus a white-hot platinum wire connected with the earth may exercise an indefinitely greater discharging power, at the same distance, than a large mass of iron at 100° C., though the latter may impart more heat to the electrified body.

Neither the mere reception of heat, however intense, by the electrified body, unless the latter have such small capacity as to be itself intensely heated, discharges the electricity if the source of heat be distant; nor is discharge effected when the electrified body and a neighbouring cold one are surrounded by air through which intense heat is passing. But, for the discharge, it is necessary that heat of intensity pass to the electrified body from a neutral body, within inductive range.

White- and red-hot metallic neutral bodies exercise this discharging power even when isolated from the earth, but always with less facility than when earth-connected.

The hotter the discharging body, whether isolated or earth-connected, the more nearly alike do + or — electricities behave in being discharged; but at certain temperatures distinct differences are noticed. The — electricity, in all cases of difference, is discharged with greater facility than the +.

Attempts are made to measure the critical temperatures at which earth-connected hot iron (1) discharges + and — electricity with nearly the same facility, (2) begins, as it cools, to show a preferential power of discharging —, and (3) ceases to discharge —. The temperatures so obtained are measured by the number of heat-units, measured from 0° C., in 1 gram of iron of the respective temperature, represented by the value of the expression $F\theta \sum u$.

It is shown that various flames, both earth-connected and isolated, have an exceedingly great power of discharging both kinds of electricity.

The effects in regard to discharge are shown to be similar when platinum wire, rendered hot by a galvanic current, is used, and also when the condensed electricity of a Leyden jar is experimented on.

As hot iron shows a preferential power of discharging — over + electricity, so it is found that white-hot but isolated iron refuses to be charged either with + or — electricity. As the iron cools, it acquires first the power of receiving — and afterwards of receiving +. Further, while white-hot iron in contact with an electrified body prevents that body from retaining a charge of either kind of electricity, as it cools it permits a + charge to be received, and subsequently a — one.

A suggestion is made as to the existence of an electrical coercitive force, the presence of which together with its diminution by heat would explain much of what has been described.

February 20, 1873.

Rear-Admiral RICHARDS, C.B., Vice-President, in the Chair.

The following communications were read :—

- I. “On the Anatomy and Histology of the Land-Planarians of Ceylon, with some Account of their Habits, and a Description of two new Species, and with Notes on the Anatomy of some European Aquatic Species.” By H. N. MOSELEY, M.A., Exeter College, Oxford. Communicated by G. ROLLESTON, M.D., Linacre Professor of Anatomy and Physiology in the University of Oxford. Received January 16, 1873.

(Abstract.)

The writer commences by expressing his great obligations to Professor Rolleston, whose pupil he formerly was. Professor Rolleston first informed him of the existence of Land-Planarians in Ceylon, and of the importance of investigating them. The paper was at first intended to be a joint one, and Professor Rolleston himself made a number of preparations of *Rhynchodemus*, one of which is figured. He likewise rendered great aid in the bibliography, and by constant suggestions and assistance during the progress of the work.

Two new species of Land-Planarians from Ceylon are described,—one belonging to the genus *Bipalium* (Stimpson), *B. Ceres*, the other to that of *Rhynchodemus*, *R. Thwaitesii*, so called after Mr. G. H. K. Thwaites, F.R.S., the illustrious curator of the Peradeniya Gardens, by whose assistance the specimens made use of were procured.